PMAS-ARID AGRICULTURE UNIVERSITY RAWALPINDI
University Institute of Information Technology

PMAS-AAUR/UIIT/1642
May 5, 2025

Subject: **Agenda Item for upcoming Academic Council**

Kindly find enclosed herewith the agenda item for the upcoming meeting of the Academic Council.

It is also mentioned that these agenda items have been discussed and approved by the faculty board of studies in its 37th meeting held on April 17, 2025.

Prof. Dr. Yaser Hafeez
Director, UIIT

The Registrar

DR Acad.

PMAS-ARID AGRICULTURE UNIVERSITY RAWALPINDI
University Institute of Information Technology

PMAS-AAUR/UIIT/1609
April 15, 2025

Subject: **37th Meeting of the UIIT Faculty Board**

A meeting of the 37th faculty board of University Institute of Information Technology (UIIT) is scheduled to be held on April 17, 2025, (Thursday) at 10:00 am at the UIIT meeting room. Following agenda items will be discussed: -

1. Launching of New Degree Program: Bachelor of Engineering Technology (Information) at UIIT
2. Initiation of Associate Degree Program in Computer Science
3. Starting of Associate Degree Program in Artificial Intelligence
4. Addition of Seats in Already Approved MSCS Program with Specialization in Artificial Intelligence (AI) and Software Engineering (SE)
5. Inclusion of Domain Elective Courses in Undergraduate Degree Programs (BSCS, BSSE)
6. Interchange of Courses in Undergraduate Degree Programs (BSCS, BSSE)
7. Change of Shift Timing in All Degree Programs from Evening to Afternoon
8. Inclusion of the additional members at UIIT faculty board
9. Inclusion of Specialized courses in postgraduate degree programs (MS/PhD)
10. Any other

All faculty board members are requested to attend the meeting as per above schedule.

Secretary
Faculty Board, UIIT

Copy to:

All members of Faculty Board

PMAS-ARID AGRICULTURE UNIVERSITY RAWALPINDI
University Institute of Information Technology

Subject: **Minutes of 37th UIIT Faculty Board Meeting**

A meeting of 37th UIIT Faculty Board was held on April 17, 2025, Tuesday at 10:00AM in UIIT meeting room. In addition to physical meeting in UIIT Committee Room, few members joined the meeting through zoom software as well and the following members in all attended the meeting:-

1.	Prof. Dr. Yaser Hafeez, Director UIIT	In-Chair
2.	Prof. Dr. Mohammad Jamil Sawar, Director BIIT	Member
3.	Prof. Dr. Saud Altaf, Chairperson NSU, Islamabad	Member
4.	Dr. Muhammad Jamal, Chairman, Department of Mathematics	Member
5.	Dr. Amber Sarwar, Head of Department, Computer Science Rawalpindi Women University	Member
6.	Dr. Bushra Zulfiqar, Hostel Warden	Member
7.	Dr. Kashif Sattar, UIIT	Member
8.	Dr. Tariq Ali, UIIT	Member
9.	Dr. Muhammad Aqib, UIIT	Member
10.	Dr. Muhammad Habib, UIIT	Member
11.	Dr. Sadia Ali, UIIT	Member
12.	Dr. Temoor Anjum, UIMS	Member
13.	Dr. Marya Iqbal, UIIT	Member
14.	Ms. Bushra Hamid, UIIT	Member
15.	Mr. Muhammad Azhar, UIIT	Member
16.	Mr. Farrukh Mehmood, IT Industry	Member
17.	Saba un Nisa, UIIT	Member/Secretary

The meeting was started with the recitation of few verses from the Holy Quran. Prof. Dr. Yaser Hafeez (Director UIIT) welcomed all the members of the Faculty Board. Further, the agenda of the meeting was shared with the members of Faculty Board by the Director UIIT. Aims and objectives of this meeting were to discuss in detail and finalize the following agenda items: -

Item 1: Launching of New Degree Program: Bachelor of Engineering Technology (Information) at UIIT

The meeting was convened to deliberate on the launching of a new undergraduate degree program titled Bachelor of Engineering Technology (Information) at UIIT. The members unanimously acknowledged the increasing demand for practice-oriented technology education that aligns with the evolving needs of industry and national development goals.

It was highlighted that several renowned institutions, including National Skills University Islamabad, UET Taxila, and many other universities across Pakistan, have already launched and successfully continued this program over the past few academic sessions. The committee noted that introducing this program at UIIT will bridge the gap between theoretical knowledge and practical skills, thereby enhancing graduates' employability in the growing fields of IT support, networking, systems management, and applied computing. The board unanimously concluded to initiate the program at UIIT, subject to fulfilling the accreditation requirements of the National Technology Council (NTC) under the Higher Education Commission (HEC). Admissions will begin in the Fall 2025 semester, with one section comprising 50 students. The program will be conducted in the afternoon to enhance accessibility and will include a mandatory supervised industrial training to ensure practical experience. The examination rules will remain the same as those for other computing disciplines at UIIT. Furthermore, for experimental purposes, if the affiliated institutes of PMAS-AAUR are willing to initiate the program, the university authorities will proceed further, subject to the codal formalities of HEC, upon receiving and processing a formal request. The updated scheme of study and admission criteria are provided in Annex-A, along with the remaining contents previously approved by the academic councils.

Item 2: Initiation of Associate Degree Program in Computer Science

The faculty board also extensively discussed the initiation of an Associate Degree program in Computer Science (2 Years Program), designed to meet the increasing market demand for skilled professionals in core computing domains. The program is structured to follow HEC's updated curriculum for Associate Degree and aims to develop foundational knowledge in computer science while offering hands-on technical skills. It was noted that institutions such as Air University, Islamabad, CUST, Virtual and NUML have successfully implemented similar programs, providing a strong precedent. A key feature of this program is the inclusion of specializations in Web Development and Mobile Application Development, allowing students to focus on practical, high-demand areas. The board acknowledged that this program would also serve as a pathway for vertical mobility into BSCS or related programs. After reviewing the structure, entry requirements, and relevance, all members agreed to formally begin the program at UIIT. Admissions for one section of 50 students will commence students admitted in Fall 2025 semester, with the program scheduled in the afternoon and including a compulsory internship component to ensure industry readiness. The updated scheme of study and admission criteria are provided in Annex-B, along with the remaining contents previously approved by the academic councils.

Item 3: Starting of Associate Degree Program in Artificial Intelligence

The board held an in-depth discussion on the proposed launch of an Associate Degree in Artificial Intelligence (2 Years Program) at UIIT. Members emphasized that the program aligns with national education reforms introduced by HEC, PHEC, and HED, replacing traditional 2-year BA/BSc degrees with market-relevant, skill-based Associate Degree. Faculty members highlighted the growing demand for professionals trained in artificial intelligence, robotics, and intelligent systems. The curriculum, developed under PHEC guidelines, includes both theoretical grounding and hands-on exposure to ensure students are equipped for industry or further academic progression. The board concluded with consensus to initiate the program at UIIT, with admission for one section of 50 students started to be admitted in Fall 2025 semester. The program will run in the afternoon to accommodate broader access and will include a mandatory internship for practical experience. The updated scheme of study are provided in Annex-C, along with the remaining contents previously approved by the academic councils.

Item 4: Addition of Seats in Already Approved MSCS Program with Specialization in Artificial Intelligence (AI) and Software Engineering (SE)

The board discussed and approved the addition of seats in the already approved MSCS program, increasing the total intake to 60 students. These seats will be divided into two specializations: Artificial Intelligence (AI) and Software Engineering (SE). The decision was made in response to growing demand and interest from prospective students for implementation from the upcoming Admission Fall 2025 intake cycle.

Item 5. Inclusion of Domain Elective Courses in Undergraduate Degree Programs (BSCS, BSSE)

Recognizing current market trends and the high demand for AI and data science skills, the board approved the inclusion of the elective courses "Machine Learning (CAI-262)" and "Artificial Neural Network & Deep Learning (CAI-361)" in BSCS and BSSE degree programs. These courses, already approved by the previous academic councils, will provide students with a strong foundation in machine learning algorithms, neural networks, and deep learning techniques, which are essential for careers in AI-driven industries. Offering these electives undergraduate programs will enhance students' employability and prepare them for advanced studies and industry challenges in AI and data science.

Item 6. Interchange of Courses in Undergraduate Degree Programs (BSCS, BSSE)

The faculty board approved a minor revision in the curriculum, involving the interchange of MTH-103 (Linear Algebra) with PHY-201 (Applied Physics). This decision was based on curriculum alignment and course sequencing to improve the learning progression for students. The change is expected to enhance conceptual understanding and logical flow in mathematical and physical sciences without affecting overall credit hour distribution.

Item 7: Change of Shift Timing in All Degree Programs from Evening to Afternoon

The faculty board discussed and approved the proposal to shift all degree programs from evening to afternoon, considering the challenges faced by female students from remote areas, such as transportation and safety concerns, and the fact that most evening shift students are ineligible for scholarships. The afternoon shift will improve accessibility and financial support opportunities. The decision follows similar practices already adopted by institutions like UET Taxila, NUML and Air University Islamabad and will be implemented from the upcoming Fall 2025 semester.

Item 8: Inclusion of the additional members at UIIT faculty board

The faculty board discussed the replacement of members who have left the UIIT faculty board and approved the adoption of new members to ensure continuity and diverse academic representation. Ms. Bushra Hamid, the exiting member, was adopted as the Secretary of the Faculty Board. The following individuals were approved as new members: Dr. Muhammad Nazir, Associate Professor at International Islamic University Islamabad; Dr. Sher Afghan, Deputy Chief ICT at Planning Commission Islamabad and Dr. Noman Noor, Assistant Professor at FAST Islamabad.

Item 9: Inclusion of Specialized courses in postgraduate degree programs (MS/PhD)

The board discussed the need to strengthen research and development in postgraduate programs (MS and PhD) by incorporating specialized courses. Applied research is a critical component of advanced education, and the inclusion of domain-specific specialized courses will enhance students' ability to contribute to cutting-edge developments in their respective fields. These courses will be designed to align with industry needs and technological advancements, ensuring that postgraduate research at UIIT remains innovative, impactful, and aligned with global trends. The outline is attached in Annex-D.

Towards the end, the meeting chair, Prof. Dr. Yaser Hafeez, Director UIIT, announced the closure of the meeting and expressed his sincere thanks to all board members for their valuable time, suggestions, and guidance. He especially thanked Prof. Dr. Mohammad Jamil Sawar (Director BIIT) for his supportive suggestions and contribution, as well as the other external members for their support and valuable input.

Prepared by

Secretary Faculty Board, UIIT
PMAS-AAUR

Confirmed by

Director, UIIT
PMAS-AAUR

Annex-A

Bachelor of Engineering Technology (Information)

i. Admission Eligibility:

Criteria for admission to Bachelor of Engineering Technology (Information) program is defined in National Technology Council (NTC) HEC Program Accreditation Policy and Procedures Manual for Engineering & Other Technologies, Clause 3.2.4.1. The Salient features for eligibility for admission are:

- A person holding intermediate (HSSC) examination certificate in (Pre- Engineering, Pre-Medical, such as A-levels/ICS/DAE or equivalent qualification certified by IBCC with at least 50% marks shall be eligible to apply for admission (sports and Hafiz-e-Quran marks are not included).
- Entrance Test
- Admission will be on open merit basis

ii. Curriculum Details

Bachelor of Engineering Technology (Information) Program			
Parameter	**HEC Framework**	**Framework - A (SIT in 7th & 8th Semesters)**	**Framework - B (SIT in 8th Semester Only)**
Program Type	Semester System	Semester System	Semester System
Program Duration	8 Semesters Min: 4 Years Max: 7 Years	8 Semesters Min: 4 Years Max: 7 Years	8 Semesters Min: 4 Years Max: 7 Years
Semester Duration	16 weeks of Teaching 2 weeks for Exams	16 weeks of Teaching 2 weeks for Exams	16 weeks of Teaching 2 weeks for Exams
Total Number of Courses	41	36	41**
Engineering Technology Domain Courses	31	26	31**
Non-Engineering Technology Domain Courses	10	10	10**
Total Credit Hours	124 – 136	134	134
Engineering Technology Domain Credit Hours	107	107	91
No. of Credit Hours per Semester	15 – 18	15 – 17	15 – 17
** Optional Courses to be included for Framework B (SIT in Semester 8 only)			
1 credit hour: 1) For theory: 1 contact hour per week for a minimum of 16 weeks for theory. (2) For practical's: 3 contact hours per week for a minimum of 16 weeks for practical's.			

CLO To PLO Mapping for Subjects of BET(I) Program

Sr. No.	Course Code	Course Title	Course Learning Outcome (CLO)	Domain	Taxonomy Level	PLO
First Semester						
1	CSC-100	Introduction to Information & Communication Technology	To become **familiar** with basic computer organization and functions of various computer hardware and software components.	Cognitive	C1	1
			Understand modern computer security risks, digital privacy and basic of computer networks.		C2	8
			To **Criticize** plagiarism and inculcate individual work and responsibility.	Affective	A3	9
2	CSC-100	IICT Lab	**Utilize** hardware components, operating systems and Office Automation tools.	Psychomotor	P3	5
			Make use of MS Office to generate technical and professional documents.	Psychomotor	P4	5
3	CSC-101	Programming Fundamentals	**Understand** the fundamental concepts and syntax of C++ programs.	Cognitive	C2	1
			Apply basic programming concepts to plan, design and implement programs that solve well-specified problems.		C3	2
			Analyze and **understand** flow of control, sequential processing, repetition processing, selection processing and use arrays, pointers and functions.		C3	3
4	CSC-101	Programming Fundamentals Lab	**Practice** to build logic, code and test program that represents the solution of problem.	Psychomotor	P3	2
			Construct syntactically and functionally correct, well-structured, program in an efficient way as per given requirements and constrains using the fundamental concepts of C++.		P4	3
			Execute different programs using modern programming compilers/tools, compute the output and identify logical and syntax errors.		P4	5
2nd Semester						
3	CSC-102	Object Oriented Programming	**Understand** the fundamental concepts and semantics of object-oriented programming and understand the difference between object-oriented, structured, and functional design paradigms.	Cognitive	C2	1
			Construct object-oriented programs using basic programming constructs specifically objects, classes, abstraction, encapsulation, inheritance and polymorphism using an object-oriented programming language, and associated class libraries.		C3	3
4	CSC-102	Object Oriented Programming (Lab)	**Practice** the principles of the object-oriented programming paradigm including abstraction, encapsulation, inheritance and polymorphism to Analyze, develop and debug programs.	Psychomotor	P3	1
			Make programs in an efficient way as per given requirements and constrains using object-oriented principles in conjuncture with an integrated development environment.		P4	5

			Apply the advanced concepts in java i.e. Abstraction, Interfaces, Exception handling and Multithreading.		P3	3
			Demonstrate knowledge of OOP and work in a team and contribute to practical lab assignments.	Affective	A3	9
3	SCS-110	Discrete Structures	**Describe** the elements of propositional logic statements and operations using truth table, logical identities, rules of inference for theorem proving	Cognitive	C2	1
			Construct inductive hypothesis along with recursive definitions using mathematical and logical notation to define and formally reason about basic mathematical concepts	Cognitive	C2	2
			Understand asymptotic notation, its significance, and be able to use it to Analyze asymptotic performance for some basic algorithmic examples with the help counting principles such as permutation and combinations	Cognitive	C3	2
4	CSC-206	Electronic Devices and Circuits	**Interpret** the basic knowledge of RC circuits and transistors to determine the frequency response of Small Signal Amplifiers.	Cognitive	C2	1
			Analyze the operation of mirror circuits and differential amplifiers based on BJT and MOSFET.	Cognitive	C4	2
			Apply the concepts of Operational Amplifiers in inverting op-amp, non-inverting op-amp, summing amplifier, difference amplifier.	Cognitive	C3	4
5	CSC-206	Electronic Devices and Circuits	To **reproduce** and investigate transistor-based amplifier circuits & their applications.	Psychomotor	P3	4
			Design and develop OP-AMP based electronic circuits and **measure** their electrical parameters.	Psychomotor	P4	3
			Ability to **report** findings related to amplifiers based on transistors and OP-AMPs both in individual and team work capacity.	Affective	A2	9
6	MTH-103	Linear Algebra	**Explain** basic terminologies, properties and operations on matrices and determinants	Cognitive	C2	1
			Utilize different procedures to solve systems of linear equations	Cognitive	C3	1
			Apply linear transformations and applies matrix theory to model real-life situations	Cognitive	C3	1
7	IS-201	Islamic Studies/Ethics	Explain and summarize the basic religious concepts of Islam and selected text of the Holy Quran and Hadith	Cognitive	C2	6
			Explain and illustrate the basic rules of fiqah, socio-economic and ethical values accordding to Islam	Cognitive	C2	8
8	ENG-201	Expository Writing	**Demonstrate** the knowledge of listening, presentation, group discussion and job interview skills	Cognitive	C2	10
			Communicate effectively in an academic presentation	Affective	A2	10
			Participate ethically in group discussion	Affective	A2	8
3rd Semester						

1	CSC-111	Digital Logic Design	**Demonstrate** and explain fundamental concepts of digital logic Circuits including basic and universal gates, number systems, and binary coded systems, basic components of combinational and sequential circuits.	Cognitive	C2	1
			Evaluate and verify the acquired knowledge to apply techniques related to the analysis of digital logic circuits and their application		C5	2
2	CSC-111	Digital Logic Design Lab	Discuss and **perform** the functionality of Logic Gates, Combinational and Sequential Circuits using standard laboratory equipment and simulation tools.	Psychomotor	P5	2
			Demonstrate the simplification techniques used to reduce the circuit complexity and construct digital systems of moderate complexity		P4	3
			Demonstrate knowledge of DLD by working in a team and **contributing** to practical lab assignments.	Affective	A2	9
3	CSC-201	Data Structures	**Explain** different data structures and discuss their typical uses, strengths, and weaknesses	Cognitive	C2	4
			Determine bugs in the program and apply acquired knowledge to **develop** different data structures		C3	3
			Formulate a group and present the findings of a project		A4	10
4	CSC-201	Data Structures Lab	**Practice** various linear and nonlinear data structures and determine the appropriate ones to solve real-world problems.	Psychomotor	P3	2
			Execute simple, recursive non-recursive algorithms with balanced complexities.		P4	5
			Design a project that **expresses/builds** your logic-building skills in a collaborative environment.	Affective	A3	11
5	STT-101	Probability and Statistics	**Demonstrate** the fundamental concepts related to experimental data.	Cognitive	C3	1
					C3	2
			Analyze probability theory analytically.		C4	4
6	CSC-205	Software Engineering	**Explain** the basic concepts related to a software development process's requirement, design, coding, and testing phases.	Cognitive	C2	1
			Examine various software development methods and understand the context in which each approach might be applicable.		C4	4
			Work individually or as a team to **express** the knowledge gained in the form of a project		A3	9
7	CSC-204	Computer Networks	**Describe** the basics of networks, internetworking devices, layered network architectures, and routing protocols.	Cognitive	C2	1
			Analyze features, services, and operations of various network, transport, and application layer protocols of the communication stack.		C4	2
			To **Criticize** plagiarism and inculcate individual work and responsibility.	Affective	A3	9

8	CSC-204	Computer Networks Lab	**Configure** and troubleshoot network devices. Analyze network traffic and apply techniques related to the design and analysis of computer networks using simulation tools.	Psychomotor	P3	5
			Implementation of Dynamic routing and redistributing them among each other.		P4	3
			Demonstrate knowledge of Computer Networks by working individually or as a **group** and contribute to projects.	Affective	A4	9
4th Semester						
1	CSC-211	Computer Organization and Assembly Language	**Explain** the fundamentals of Computer architecture.	Cognitive	C2	1
			Compare the different computing scenarios to determine the better solution.		C4	2
2	CSC-211	Computer Organization and Assembly Language Lab	**Discuss** programs and subroutines in Assembly Language that use various classes of machine instruction	Psychomotor	P3	5
			Design and implement a project in a group.		P4	11
			Actively contribute while performing assigned lab work and **follow** provided instructions whether working individually or in groups.		A3	9
3	cse-322	Software Project Management	**Examine** the fundamental concepts of Project Management	Cognitive	C2	11
			Apply basic theories of Project Management necessary analytical skills to successfully select, design, implement, control, and terminate projects of varying complexities.		C3	11
			Develop the ability to communicate an academic argument supported by the literature		C3	11
4	ELE-270	IDTE-1 (Signal and Systems)	**Understand** and characterize the properties of continuous time (CT) and discrete-time (DT) signals and systems as well as convolution in time domain	Cognitive	C2	1
			Apply Fourier Analysis tools, to represent CT and DT signals and systems in frequency domain.	Cognitive	C3	3
5	ELE-270	IDTE-1 (Signal and Systems) Lab	Display and **investigate** competence in using professional software tools like MATLAB and study the response of different type of continuous and discrete time signals and systems, and their transforms	Psychomotor	P2	4
			Propose and **develop** semester project meeting the time constraint by efficient planning and time management.	Psychomotor	P3	11
			Ability to **report** and present findings relevant to key concepts and comply with the procedures taught in the lab both in individual and team work capacity.	Affective	A2	9
6	CSC-251	Web Technology	**Describe** various current tools, technologies, protocols, standards, and best practices used for the development of dynamic web-based systems.	Cognitive	C2	1
			Utilize HTML and CSS to **Design** and **Analyze** basic webpages, a standard-compliant front end of a static or dynamic web application, and back-end functionalities under specific requirements.	Cognitive	C6	3

7	CSC-251	Web Technology Lab	To be familiar with HTML Basics and **make** use of HTML and CSS to develop static standard-compliant websites	Psychomotor	P4	5
			To be able to **construct** interactive and dynamic webpages with AJAX.		P7	5
			Demonstrate knowledge of Web Development by working individually or as a team and **contribute** to practical lab projects.	Affective	A3	9
8	CSE-322	Software Testing & Quality Assurance	**Explain** basics of software quality assurance and testing fundamentals.	Cognitive	C3	1
			Analyze different scenarios to grasp working mechanism of various testing techniques.		C4	2
9	CSC-301	Operating Systems	**Describe** the core concepts of an operating system, memory, process, and file management.	Cognitive	C2	1
			Analyze important algorithms e.g., Process Scheduling and memory management algorithms.		C4	2
			Determine the applications and principles on which the core functions of the operating system are built on.		C6	4
10	CSC-301	Operating Systems Lab	**Demonstrate** the ability to perform OS tasks in Linux and Windows Server by working individually or as a team.	Affective	A3	9
			Execute modern Operating Systems using learned knowledge and skills.	Psychomotor	P4	5
					A3	9
5th Semester						
1	CSC-203	Artificial Intelligence	**Utilize** various AI search algorithms (tree search, uninformed, informed, and heuristic), understand different types of AI agents, know how to build simple knowledge-based systems.	Cognitive	C3	3
			Ability to **elaborate** knowledge representation, reasoning, and machine learning techniques to real-world problems		C6	6
2	CSC-203	Artificial Intelligence Lab	Demonstrate **proficiency** in developing applications in an 'AI language', expert system shell, or data mining tool.	Psychomotor	P4	3
			Design an AI framework for real-world problems.		P7	5
			Demonstrate knowledge of AI by working as an individual or in teamwork by **committing** to practical lab assignments.	Affective	A3	9
3	CSC-449	Cloud Computing	**Demonstrate** the core concept of the cloud computing paradigm, cloud services, and deployment model	Cognitive	C2	1
			Analyze and **evaluate** various cloud computing solutions.		C5	4
4	CSC-449	Cloud Computing Lab	**Configure** various virtualization tools such as Virtualbox, and VMware workstation.	Psychomotor	P3	5
			Design and deploy web applications in a cloud environment		P7	3
			Work in a **group** to design and implement a project.	Affective	A4	9
5	CSC-303	Advanced Database Management System	**Distinguish** the fundamental concepts related to databases and different database schemas	Cognitive	C4	2
			Design conceptual, logical, and physical database schemas and normalize the relations to remove anomalies		C6	3

6	CSC-303	Advanced Database Management System Lab	**Execute** SQL queries for database definition and manipulation of any relational database.	Psychomotor	P4	2
			Design conceptual and relational databases using modern tools.		P7	5
			Demonstrate knowledge of databases by working individually on lab tasks or collaboratively in **group** projects.	Affective	A4	9
7	ENG-401	Technical and Business Writing	**Demonstrate** knowledge of the basics of technical communication, its traits, and process to prepare technical reports	Cognitive	C2	10
			Develop proficiency in business/ professional correspondence	Cognitive	C3	12
8	CSC-498	FYP-1	Develop/Design a sustainable engineering solution of the complex engineering problem through his/her project/research work	Psychomotor	P7	7
			Show professionalism, ethical conduct and moral responsibility in all aspects of his/her research/project work	Psychomotor	P4	8
			Exhibit necessary tasks required in completion of his/her research/project work as an individual or as a team member.	Affective	A3	9
			Defend his/her project/research work in logical/well-planned way in thesis report, poster and in oral presentation by appropriate communication and professional skills.	Affective	A5	10
			Organize his/her project/research work by practicing management principles including punctuality, commitment, decision making and dedication.	Affective	A4	11
			Build project/research work in a broader context and pursue autonomous lifelong learning through creativity, innovation and technological advancement.	Psychomotor	P5	12
6th Semester						
1	CSC-436	Big Data Analytics	**Understand** the fundamental concepts of Big Data and its programming paradigm.	Cognitive	C2	1
			Apply Hadoop/MapReduce Programming, Framework, and Ecosystem.	Cognitive	C3	3
2	CSC-436	Big Data Analytics Lab	**Understand** the fundamental concepts of Big Data and its programming paradigm	Cognitive	C2	1
			Apply Hadoop/MapReduce Programming, Framework, and Ecosystem.	Psychomotor	P4	3
			Express the experimental data in the appropriate format in the form of a LAB report	Affective	A3	9
3	CSC-354	Cyber Security	To be able to identify computer system threats.	Cognitive	C1	2
			To be able to identify attacks related to end point and network and understand the stages of attack and payloads.	Cognitive	C2	3
			Understanding of digital forensics needs and commonly used tools.	Cognitive	C5	2
4	CSC-354	Cyber Security Lab	To be able to use appropriate tools for preventing and detecting the attacks related to end point systems and network.	Psychomotor	C3	5
			To be able to implement various data protection techniques.	Psychomotor	C4	5

5	SSH-402	Professional Practices in IT	**Explain** basic engineering ethics, variety of moral issues and moral dilemmas.	Cognitive	C2	2
			Apply codes of ethics/professional conduct to real world scenarios.	Cognitive	C3	9
			Demonstrate the ability to communicate, both in written and oral form about potential problems.	Affective	A2	7
6	SSH-401	Entrepreneurship	**Analyze** the market trends to identify viable business opportunities within the industry and apply principles of intellectual property and legal considerations.	Cognitive	C4	4
			Develop/Manage comprehensive business plans for new ventures, considering product/service innovation, market strategies, and financial projections in a society.	Psychomotor	P5	6
			Create and **Present** effective pitches for startup ideas to potential investors and stakeholders	Affective	A2	9
7	ELE-271	IDTE-2 (Control Technology)	**Describe** the behavior of control systems using engineering principles and mathematical modeling for electrical and mechanical systems.	Cognitive	C2	1
			Analyze control engineering problems by evaluating time response, steady-state dynamics, and stability using appropriate methods.	Cognitive	C4	2
8	ELE-271	IDTE-2 (Control Technology Lab)	Gain practical proficiency in using MATLAB and Simulink to **simulate, analyze, and design** control systems, with hands-on experience in controller design and real-time system performance evaluation.	Psychomotor	P3	5
			Apply the theoretical knowledge to evaluate system behaviour, stability, and performance in a variety of control applications.	Cognitive	C3	1
			Justify the ability to work effectively as an individual or in a team.	Affective	A2	9
9	CSC-499	FYP-2	Develop/Design a sustainable engineering solution of the complex engineering problem through his/her project/research work		P7	7
			Show professionalism, ethical conduct and moral responsibility in all aspects of his/her research/project work		P4	8
			Exhibit necessary tasks required in completion of his/her research/project work as an individual or as a team member.		A3	9
			Defend his/her project/research work in logical/well-planned way in thesis report, poster and in oral presentation by appropriate communication and professional skills.		A5	10
			Organize his/her project/research work by practicing management principles including punctuality, commitment, decision making and dedication.		A4	11
			Build project/research work in a broader context and pursue autonomous lifelong learning through creativity, innovation and technological advancement.		P5	12

iii. Semester-wise Scheme of Studies

Semester-wise scheme of studies for Bachelor of Engineering Technology (Information) program, spanning 4 years, spread over 8 semesters, and totaling 134 credit hours, is presented below:

1st Semester

Sr. No	Course Code	Pre Reqs	Subject	Nature	Credit Hours
1.	CSC-100		Application of Information & Communication Technologies	Engineering Foundation	3(2-3)
2.	CSC-101		Programming Fundamentals	Engineering Foundation	4(3-3)
3.	ELE-401		Basic Electronics	Engineering Foundation	3(2-3)
4.	MTH-101		Calculus and Analytic Geometry	Natural Sciences	3(3-0)
5.	ENG-102		Functional English	Humanities/English	3(3-0)
6.	SSH-303		Pakistan Studies	Humanities	2(2-0)
			Total Credit Hours		**18**

2nd Semester

Sr. No	Course Code	Pre Reqs	Subject	Nature	Credit Hours
1.	CSC-102	CSC-101	Object Oriented Programming	Engineering Foundation	4(3-3)
2.	CSC-110		Discrete Structures	Engineering Foundation	3(3-0)
3.	CSC-206		Electronic Devices and Circuits	Engineering Foundation	3(2-3)
4.	MTH-103	MTH-101	Linear Algebra	Natural Sciences	3(3-0)
5.	IS-201		Islamic Studies/Ethics	Humanities	2(2-0)
6.	ENG-201	ENG-102	Expository Writing	Humanities/ English	3(3-0)
			Total Credit Hours		**18**

3rd Semester

Sr. No	Course Code	Pre Reqs	Subject	Nature	Credit Hours
1.	CSC-111		Digital Logic Design	Engineering Foundation	3(2-3)
2.	CSC-201	CSC-101	Data Structures	Engineering Foundation	4(3-3)
3.	CSC-205		Software Engineering	Major based Breadth	3(3-0)
4.	CSC-204		Computer Networks	Major based Depth	3(2-3)
5.	STT-101		Probability and Statistics	Natural Science	3(3-0)
			Total Credit Hours		**16**

4th Semester

Sr. No	Course Code	Pre Reqs	Subject	Nature	Credit Hours
1.	CSC-301		Operating Systems	Major based Breadth	3(2-3)
2.	CSC-211	CSC-111	Computer Organization & Assembly Language	Major based Breadth	3(2-3)
3.	ELE-270		IDTE-1 (Signal & System)	Inter-Disciplinary	3(2-3)
4.	CSC-252	CSC-102	Advanced Programming	Major based Depth	3(2-3)
5.	CSE-422		Software Testing & Quality Assurance	Major based Breath	3(2-3)
6.	CSE-322		Software Project Management	Major based Breath	3(2-3)
			Total Credit Hours		**18**

5th Semester

Sr. No	Course Code	Pre Reqs	Subject	Nature	Credit Hours
1.	CSC-303		Advanced Database Management Systems	Major based Breadth	3(2-3)
2.	CSC-203		Artificial Intelligence	Major based Breadth	3(2-3)
3.	CSC-449		Cloud Computing	Major based Depth	3(2-3)
4.	CSC-498		Final Year Project-I	Senior Design Project	3(3-0)
5.	ENG-401	ENG-201	Technical & Business Writing	Humanities/English	3(3-0)
			Total Credit Hours		**15**

6th Semester

Sr. No	Course Code	Pre Reqs	Subject	Nature	Credit Hours
1.	CSC-436		Big Data Analytics	Major based Depth	3(2-3)
2.	CSC-354		Cyber Security	Major based Depth	3(2-3)
3.	SSH-401		Entrepreneurship	Management Sciences	2(2-0)
4.	ELE-271		IDTE-2 (Control Tech)	Inter-Disciplinary	3(3-0)
5	SSH-402		Professional Practices	Humanities	3(3-0)
6.	CSC-499	CSC-498	Final Year Project-II	Senior Design Project	3(3-0)
			Total Credit Hours		**17**

7th Semester

Sr. No	Course Code	Subject	Credit Hours	
1.	SIT-498	Supervised Industrial Training	00	16
Grand Total			16	

Or

7th Semester **

Sr. No	Course Code	Pre Reqs	Subject	Nature	Credit Hours
1.	CSC-251		Web Technologies	Optional	3(2-3)
2.	CSC-258		Virtual Systems & Services	Optional	4(3-3)
3.	CAI-262	CSC-203	Machine Learning	Optional	3(2-3)
4.	CAI-361		Artificial Neural Networks & Deep Learning	Optional	3(2-3)
5.	CSC-353		Mobile Application Development 1	Optional	3(2-3)
			Total Credit Hours		**16**

8th Semester

Sr. No	Course Code	Subject	Credit Hours	
1.	SIT-499	Supervised Industrial Training	00	16
Grand Total			16	

Course Contents

CSC-449 Cloud Computing 3(2-3)

Definition and history of cloud computing. - Characteristics and advantages of cloud computing. Cloud service models: IaaS, PaaS, SaaS. - Public, private, hybrid, and multi cloud deployments. - Use cases for different cloud service models. - Major cloud providers: AWS, Azure, GCP, etc. - Core services and offerings by each provider. - Introduction to virtual machines (VMs). - Docker containers and containerization. - Virtual networks, subnets, and security groups. - Setting up Virtual Private Clouds (VPCs) or Virtual Networks (VNets). - Amazon EBS, Azure Disks. - Introduction to relational databases (RDS, Azure SQL Database). - AWS Lambda, Azure Functions, Google Cloud Functions. - Writing and deploying server less functions. - AWS Lambda, Azure Functions, Google Cloud Functions. - Writing and deploying server less functions. - Event-driven architecture and integrating with event sources. Role-based access control. - Identity and Access Management (IAM) policies. Security best practices and authentication mechanisms. Regulatory compliance (e.g., GDPR, HIPAA). Data encryption, auditing, and data protection measures. - Introduction to Continuous Integration (CI) and Continuous Deployment (CD). CI/CD tools and practices in the cloud. Infrastructure as Code (IaC) with AWS Cloud Formation or Azure Resource Manager. - Using cloud-native monitoring tools (e.g., AWS Cloud Watch, Azure Monitor). - Setting up alarms, metrics, and log analysis. - Cost analysis and optimization strategies. - Reserved instances, spot instances, and cost allocation. Real-world cloud adoption case studies. - Best practices for cloud resource management. - Edge computing, server less trends, and AI in the cloud. Discussion on the future of cloud technology.

RECOMMENDED TEXT BOOKS:

1. Cloud Computing: Principles and Paradigms, RajkumarBuyya, James Broberg, and Andrzej M. Goscinski
2. Cloud Computing: Concepts, Technology & Architecture, Thomas Erl, Zaigham Mahmood, and Ricardo Puttini
3. Amazon Web Services in Action, Andreas M. Wittig and Michael Wittig
4. Azure for Architects, Ritesh Modi
5. Google Cloud Platform in Action, ValliappaLakshmanan, Eitan Goldin, and Martin Görner

CSC-436 Big Data Analytics 3(2-3)

History of big data, its elements, career related knowledge, advantages, disadvantages and similar topics. focus on the application perspective of Big Data covering topics such as using big data in marketing, analytics, retail, hospitality, consumer good, defense etc. Big Data is primarily characterized by Hadoop. This module cover topics such as Introduction to Hadoop, functioning of Hadoop, Cloud computing (features, advantages, applications) etc. Big Data is primarily characterized by Hadoop. This module cover topics such as Introduction to Hadoop, functioning of Hadoop, Cloud computing (features, advantages, applications) etc. Data preprocessing, Lab practice in python, Feature selection, Lab practice in python,

Feature Extraction, Lab practice in python, Dimension reduction, Lab practice in python, Normalization, Outlier detection, Lab practice in python, Visualization, Lab practice in python, Neural Network: Introduction to Artificial Neural Networks, (ANN), ANN Applications, Neural Network: Topologies of ANN, Single Layer perception, (SLP)., Back Prop algorithms: Multi Layer Perception (MLP), Back Prop, Algorithm, Genetic Algorithm: Introduction to Evolutionary Computing, Genetic Algorithm (GA), Genetic Algorithm: Applications of Genetic Algorithm and its examples, Genetic Algorithm: Genetic operators (Crosse over and Mutation) and its applications, Genetic Algorithm: G.A Pseudo Code, Examples, Particle Swarm Optimization (PSO): Particle Swarm Optimization (PSO), Machine Learning: Introduction to Learning, Supervised, Learning (decision Tree), Machine Learning: Introduction to Learning, Supervised, Learning (random forest), Machine Learning: Unsupervised Learning, K-means Clustering, Algorithm, Unsupervised Learning, Deep learning

RECOMMENDED TEXT BOOKS:

1. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeff Ullman, 2nd edition, 2011
2. Hadoop: The Definitive Guide, Tom White, 4th edition. 2009.
3. Data-Intensive Text Processing with Map Reduce, Jimmy Lin and Chris, 2010

ELE-401 Basic Electronics 3(2-3)

Introduction to Electronic Devices & Circuits: To understand the atomic structure, Electric Charge, Conductors, Insulators, Semiconductors. Basic Concepts of semiconductors: Intrinsic and Extrinsic Semiconductors., Doping and energy levels. Diodes: PN junction/ Biased PN junction, V-I Characteristics, Load Line and dynamic resistance. Diodes: Diode models. Reverse recovery time and temperature effects. Diode Applications: Rectifiers Half Wave and Full Wave Rectifiers, Clippers and Clampers. Bipolar Junction Transistors (BJTs): Construction, operation and characteristics. Amplifying action and variation in current gain. Common Emitter, Common Collector and Common Base Configurations. Power Ratings. BJT Biasing Circuits: Fixed Bias, Voltage Divider Bias and Emitter feedback Bias Circuits, DC load line and operating point Biasing circuit design and stabilization, Transistor as a switch. BJT Small Signal Analysis: Common Emitter Amplifier ,Common Base Amplifier ,Common Collector Amplifier, Amplifier Design and Loading effects, Field Effect Transistors (FETs): JFET Construction and Operation, Transfer characteristics and parameters. FET Biasing Circuits: Fixed Bias, Self-Bias and Voltage divider Bias, Design of a bias circuit, FET Small Signal Analysis, JFET/Depletion MOSFET small-signal model, Common source, common drain and common gate amplifiers, Loading effects and design of amplifier circuits

RECOMMENDED TEXT BOOKS:

1. Electronic Devices & Circuits Theory, H. Boylestad, L. Nashelsky
2. Electronics Devices, Thomas L Floyd
3. Electronic Principles, Albert Malvino, David Bates
4. Basic Electrical & Electronics, S.K. Bhattacharya, Pearson, Latest Edition
5. Electrical Technology, B.L Theraja, A.K Theraja, Latest Edition

CSC-354 Cyber Security 3(2-3)

Understanding Access control and Monitoring Systems, Security Policies, Physical Security controls, Access Control Gates, Authentication systems, Intrusion Detection, Reporting systems, sensors, output devices, Infrastructure security, security challenges, Three layers of security, securing host devices Securing operating systems, security choices, security tools, Securing remote access, firewall installation, installing and using antimalware software, disabling non-essential services, Applying updates and patches, anomaly detection, hardening systems, Networking basics, LAN, MAN, WAN, OSIlayers, Network topologies, Network protocols, MAC addresses, IP address, Ethernet, TCP/IP, Server Security, Server administration, Servers software security, Network devices (wired, wireless), router, switch bridge vulnerabilities, network attacks, network hardening, Local network security, basics of internet security, Firewalls, Securing data inmotion, encryption, digital signatures, hashing, Identifying and defending against vulnerabilities zero day attacks, phishing,vishing, sql injections.

RECOMMENDED TEXT BOOKS:

1. Brooks,CJ,Craig,PA&ShortD2017,Cyber security Essentials, SYBEX,Hoboken,NJ.
2. Chapple, M., Stewart, J.M. and Gibson, D., 2018.(ISC) 2 CISSP Certified Information Systems Security Professional Official Study Guide. John Wiley & Sons.

CSC-206 Electronic Devices and Circuits 3(2-3)

The course Electronic Devices and Circuits provides a foundational understanding of semiconductor theory and electronic components essential to modern electronic systems. It begins with an introduction to semiconductors, covering intrinsic and extrinsic types, doping mechanisms, and associated energy levels. The course then explores diodes, including PN junction behavior, V-I characteristics, load line analysis, diode models, reverse recovery, temperature effects, and applications such as rectifiers, clippers, clampers, and logic gates. Emphasis is placed on special diodes like Zener and LEDs, along with their testing and specifications. The study progresses to Bipolar Junction Transistors (BJTs), focusing on their construction, operating limits, amplification principles, and configurations including common emitter, collector, and base. Students learn about transistor biasing techniques—such as fixed bias, voltage divider, and emitter feedback—to establish stable operating points, followed by AC analysis and amplifier modeling. The course concludes with Field Effect Transistors (FETs), including JFET and depletion-mode MOSFETs, covering construction, biasing, transfer characteristics, and small-signal models. Amplifier configurations such as common source, drain, and gate are analyzed in terms of performance and loading effects, preparing students for advanced electronics and circuit design.

RECOMMENDED TEXT BOOKS:

1. Boylestad, R., & Nashelsky, L. (2014). *Electronic devices and circuit theory*. Prentice Hall.
2. Bogart, T. F. (2004). *Electronic devices and circuits*. Pearson Education India.
3. Ștefan, O. (2020). Circuite digitale I.

ELE-270 **Signal & System** **3(2-3)**

Signal processing plays an extremely important and continually growing role in a wide variety of engineering systems. Furthermore, technology and algorithms for signal processing continue to develop rapidly. While only a short time ago signal processing systems were predominantly analog, integrated circuit technology has made digital signal processing often preferable and more cost-effective.

This course is an introduction to the basic concepts and theory of analog and digital signal processing. The background assumed is calculus, experience in manipulating complex numbers, and some exposure to differential equations. Prior exposure to the fundamentals of circuits for electrical engineers or fundamentals of dynamics for mechanical engineers is helpful but not essential. Both for pedagogical reasons and as a reflection of the nature of modern signal processing systems, the concepts associated with continuous-time and with discrete-time signals and systems are treated together in a closely coordinated way. Among other things, this approach emphasizes both the similarities and the differences in the two classes of systems. Developing this video course has been an extremely enjoyable and rewarding experience. I hope that you also find it enjoyable, stimulating, and rewarding.

RECOMMENDED TEXT BOOKS:

1. Palani, S. (2022). *Signals and systems* (pp. 921-1055). Cham: Springer.

ELE-271 **Control Tech** **3(2-3)**

Control Tech offers a hands-on introduction to control systems with a strong emphasis on modeling, simulation, and practical implementation using DC motors. Students begin by learning the basics of MATLAB programming, including function usage, plotting, and script development. The course progresses to system modeling through step responses and transfer function estimation, followed by open-loop and closed-loop control techniques both in MATLAB/Simulink and through analog circuits. Key concepts such as stability analysis using the Routh-Hurwitz criterion, system damping, natural frequency, and transient response characteristics are explored. Students design and evaluate controllers, including proportional compensators, and analyze steady-state errors. The course concludes with frequency response modeling, equipping students with essential skills to analyze, simulate, and implement real-world control systems effectively.

RECOMMENDED TEXT BOOKS:

1. Nise, N. S. (2020). *Control systems engineering*. John Wiley & Sons.

CSE-322 **Software Project Management** **3(2-3)**

Software Project Management & Methodologies, Process Vs Project Management, PMI, PMBOK., Project Management Processes, Project Lifecycle, SDLC ISO-12207, PMI & PRINCE2, Process Groups and Knowledge Areas, Planning process, Project Scope Management, Project Charter, The knowledge area of

Project Scope Management, Stakeholder Analysis, Stakeholder Roles and Responsibilities, WBS, Scope Management, Project Charter, Defining Project Goals, Software Project Planning, Estimating, Scheduling, Life Cycle Models, Project Activity Planning, Software Project Time Management, Activity Sequencing, Types of Dependencies, Network Diagrams, Critical Path Method, Arrow Diagramming Method ADM, Software Project Time Management, Activity on Arrow (Arrow Diagramming), The forward pass, The Backward pass, PERT, Software Project Risk Management, Software Risk Management, Potential Negative Risk Conditions Associated with Each Knowledge Area, Software Project Communication Management, Conflict Management, Managing Conflict – STAR, Software Project Selection Methods, Cost benefit analysis, Financial Return methods, Net Profit, Net Present Value Analysis, CBA- Discount Factor, Software Project Selection Methods, Return on investment (ROI), IRR, Project Procurement Management, Contracts, Project procurement process, Planning, purchases and acquisitions, Types of contracts, Request for proposal, Statement of work, Software Project Human Resource Management, Resource Allocation, Responsibility Assignment Matrices RAM, RAM Showing Stakeholder Roles, Software Project Estimations, Size of Software Project, COCOMO model, Function point Analysis, Object point Analysis, Software Outsourcing, Project Management in Globally Distributed Environments, Agility in Software Project Management, Modern Paradigm and Implications of SPM, DevOps Principles, CI/CD Pipelines, Infrastructure as Code

RECOMMENDED TEXT BOOKS:

1. Effective Project Management, Robert, K., Wiley, 9th Edition, 2011.
2. Information Technology Project Management, Schwalbe, K., 9th Edition (2019), Cengage Learning.
3. Software Project Management, Hughes, B. &Cotterell, M., 6th Edition (Oct. 2017). McGraw-Hill Higher Education.
4. Software Project Management – Hughes &Cotterell, 7th Edition (2021)

CSE-422 Software Testing & Quality Assurance 3(2-3)

Introduction to Software Testing, Understanding Software Quality, Quality Revolution, Software Quality Concepts, Role of Testing in Software Quality, Fundamentals of Software Testing, Verification and Validation, Failure, Error, Fault, and Defect, Notion of Software Reliability, Objectives of Testing, Test Cases and Expected Outcomes, Concept of Complete Testing, Testing Strategies and Levels, Central Issues in Testing, Testing Activities, Levels of Testing (Unit, Integration, System, Acceptance), Sources of Information for Test Case Selection, White-Box and Black-Box Testing, Test Management and Planning, Test Planning and Design, Monitoring and Measuring Test Execution, Test Tools and Automation, Test Team Organization and Management, Concepts and Techniques, Static and Dynamic Unit Testing, Defect Prevention, Mutation Testing, Debugging Techniques, Tools and Automation, Unit Testing in Extreme Programming, JUnit Framework for Unit Testing, Tools for Automated Unit Testing, Quality Assurance Concepts**,** Control Flow Testing, Control Flow Graphs and Paths, Path Selection Criteria**,** Dynamic Data Flow Testing, Test Selection Criteria and Feasibility, Data Flow Anomalies, Test Selection Criteria and

Feasibility, Domain Testing, Types and Sources of Domain Errors, Testing Criteria and Selection**,** System Integration Testing, Interface Errors and Integration Techniques, Hardware and Software Integration, Off-the-Shelf Component Testing, Introduction to Test Automation Frameworks, System Test Categories, Functional, Robustness, Performance, and Security Tests, Regression Testing and Documentation Testing, Automated Test Script Development, Equivalence Class Partitioning, Boundary Value Analysis, System Test Design, Requirement Identification and Test Objectives, Test Suite Structure and Execution Strategy, Estimation and Scheduling, Test Automation Infrastructure, Acceptance Testing, Acceptance Criteria and Execution, Test Reporting and Extreme Programming, Software Reliability, Definitions and Measurement Techniques, Operational Profiles and Reliability Models, Test Team Organization, Roles and Responsibilities, Recruiting and Retaining Test Engineers, Software Quality and Maturity Models, McCall's Quality Factors, ISO 9126 and CMMI, Testing Maturity Model, Emerging Trends in Software Testing Cont, Industry Best Practices and Case Studies.

RECOMMENDED TEXT BOOKS:

1. Software Testing: Concepts and Operations. Ali Mili, Fairouz Tchier.
2. Fundamentals of Software Testing Bernard Homes,1/E,Wiley
3. Software Verification and Validation for Practitioners & Managers, Steven R. Rakitin
4. Software Testing, Testing Across the Entire SDLC, GeraldD. Everett,
5. Software Quality Engineering, Testing, Quality Assurance, and Quantifiable Improvement, Jeff Tian, John-Wiley & Sons.

CSC–258 Virtual System and Services 3(2-2)

Introduction & Background, understanding virtualization, what is virtualization? How does virtualization work? Types of Virtualizations, Business perspective and management of Virtualized IT services, Virtualization management. Difference between cloud and Virtualization? Virtual machines (VM), Types of hypervisors, Introduction to Virtualization vendors: VMW are, Microsoft Hyper-V - Hardware requirements and configurations for virtualization, VMW are: Virtualization Infrastructure Overview, Introduction to Bare Metal Hypervisor, VMW are: Introduction to vCenter, Clones, ESXi and vCenter Permission Model, The VMware File System, VMW are: Resource Management and Resource Pools, Host Profiles, VMW are: VM Hot and Cold Migration, Load Balancing with Distributed Resource Scheduler, Managing Scalability and Performance, XEN: Introduction to XEN virtualization, Basic architecture of XEN – XEN: Virtual machine management, Using native XEN utilities, Advanced installation and configuration, XEN: Live migration, Advanced configuration of xend, Troubleshooting, Hyper-V: Introduction to Hyper-V, Introduction to Hyper-V manager, Configure Hyper-V hosts, Hyper-V: Configure and manage Hyper-V virtual machines, Configure storage options and shared VHDs, Hyper-V: Securing workloads, Configuring Host Guardian Services (HGS), Configuring and implementing Replica, Virtualization vs. containerization, Containers, Dockers, Containers vs. virtual machines (VMs), Benefits of containers, Use cases for containers, Cloud container services, Containerization, Fundamentals of Docker, Getting Started with Docker, Docker, Orientation and setup, Anatomy of a Docker, What is Docker / What

is Docker Not, Basic Docker Commands, Anatomy of a Docker image Docker volumes, image Docker volumes Volume use cases, Docker Swarm, Docker compose / stacks Secrets, PWD: Swarm stack introduction, PWD: Docker Compose with Secrets, Develop a strategy for integrating, Docker into your existing production environment, Moving to Production, Reference Implementations, Portability, Storage, Production anti-patterns, Docker for IT Pros and System Administrators, Getting Started Walk-through for Developers:core concepts of Docker, How to build and deploy multi-service applications, Use Docker with various IDEs, Get started with Windows containers, Preparing your workflow, Deploy an application to a staging environment, Manage your staging environment with Docker Swarm Mode, Istio, Knative, and the expanding containers ecosystem, Container orchestration with Kubernetes, From Monolith to Microservices, Container, Kubernete, Kubernetes Architecture – Overview Installing Kubernetes Orchestration, Kubernetes Volume Management, ConfigMaps and Secrets, Ingress, Limitation of Virtualized Environments, Future of virtualization, Advanced Topics in Virtualization

RECOMMENDED TEXT BOOKS:

1. *Hands-On Virtual Computing*, 2nd Edition, Ted Simpson**,** Cengage Learning**;** (January 1, 2018), ISBN: 978-1337101936.
2. *Building Virtual Machine Labs: A Hands-On Guide*, 1st Edition, Tony Robinson**,** CreateSpace Independent Publishing Platform**;** (May 12, 2017), ISBN: 978-1546932633
3. Virtualization Essentials 2nd Edition Matthew Portnoy
4. Handbook of Virtual Environments: Design, Implementation, and Applications (Human Factors and Ergonomics), 2nd Kay M Stanney, Lawrence Erlbaum CRC Press; (January 1, 2002) 978-0805832709
5. *Hardware and Software Support for Virtualization*, 1st Edition, Edouard Bugnion**,** Springer**;** (2022)
6. Associates Virtual Reality Technology 2nd GRIGORE Wiley-IEEE Press 2007 9781119485728.
7. *Virtual Machines: Versatile Platforms for Systems and Processes*, 1st Edition**,** Jim Smith**,** Elsevier**;** (2018)

CSC-303 Advance Database Management Systems 3(2-3)

Overview of Relational DBMS, Concepts of Relational Databases, Integrity Constraints, Normalization, Review of Database Systems, Relational Algebra, Relational Calculus, Relational Database Management System, DBMS Architecture, Client/Server System, Peer-to-Peer Distributed System, Multi-Database System, Transaction Management, Basic Concepts of Transaction Management, ACID Properties of Transactions, Objectives of Transaction Management, Classification of Transactions, Concurrency Control, Objectives of Concurrency Control, Concurrency Control Anomalies, Serializability, Classification of Concurrency Control Techniques, Locking-based Concurrency Control Protocols, Timestamp-Based Concurrency Control Protocols, Optimistic Concurrency Control, Technique, Deadlock, Techniques for Handling Deadlock, Timeout, Deadlock Prevention, Deadlock Detection and Recovery, Wait-For-Graph (WFG), Recovery from deadlock detection, Database Recovery, Types of Failures, Transaction and Recovery, Recovery Techniques, Deferred Update, Immediate Update, Shadow Paging, Distributed Database Concepts, Fundamentals of Distributed Databases, Features of a Distributed DBMS, Advantages and Disadvantages of Distributed DBMS, Homogeneous and Heterogeneous Distributed DBMSs, Functions

of Distributed DBMS, Date's 12 Objectives for Distributed Database Systems, Overview of Computer Networking, Introduction to Networking, Types of Computer Networks, Communication Schemes, Network Topologies, The OSI Model, Network Protocols, Distributed Database Design, Distributed Database Design Concepts, Alternative Approaches for Distributed Database Design, Objectives of Data Distribution, Alternative Strategies for Data Allocation, Data Fragmentation, Benefits of Data Fragmentation, Correctness Rules for Data Fragmentation, Different Types of Fragmentation, The Allocation of Fragments, Transparencies in Distributed Database Design, Distributed Query Processing, Concepts of Query Processing, Objectives of Distributed Query Processing, Phases in Distributed Query Processing, Mobile Databases and Object-Oriented DBMS, Mobile Databases, Mobile DBMS, Introduction to Object-Oriented Databases, Object-Oriented Database Management Systems.

RECOMMENDED TEXT BOOKS:

1. Principles of Distributed Database Systems Fourth Edition by M. Tamer Özsu, Patrick Valduriez
2. Distributed database systems 1st edition by Chhanda Ray
3. Database Systems: A Practical Approach to Design, Implementation, and Management, 6th Edition by Thomas Connolly and Carolyn Begg
4. Database Management Systems, 3rd Edition by Raghu Ramakrishnan, Johannes Gehrke
5. Database System Concepts, 6th Edition by AviSilberschatz, Henry F. Korth and S. Sudarshan.
6. Database Systems: The Complete Book, 2nd Edition by Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom

ADAI–Associate Degree in Artificial Intelligence (2 Years Program) & ADCS - Associate Degree in Computer Science (2 Years Program) with specialization in (Web Development & Mobile Application Development)

Admission Eligibility:

- A person holding intermediate (HSSC) examination certificate in (Pre- Engineering, Pre-Medical, ICS or equivalent qualification certified by IBCC with at least 50% marks shall be eligible to apply for admission.
- Admission will be on open merit basis

Structure and Academic Requirements for Associate Degree 2 Years Programs:

a) **Credit Hours**: The standard range prescribed to qualify for the Associate Degree is 60-72 credit hours with a normal range of 15-18 credit hours in each semester. The university may offer maximum of 21 credit hours in a semester where there is a program specific requirement of the same provided that the total number of credit hours for the Associate Degree program must not exceed beyond 72 credit hours.

b) **General Education Courses**: All Associate Degree programs shall be comprised of at least set of 21 credits hours for general education courses as prescribed in this policy.

c) **Major Courses**: All Associate Degree programs shall be comprised of a mandatory set of 30-46 credit hours for major or disciplinary courses.

d) **Field Experience/Internship**: The field experience of six to eight weeks (preferably undertaken during semester or summer break) must be graded by a faculty member in collaboration with the supervisor in the field. This requirement of 02 credit hours is applicable.

e) **CGPA Requirement**: The minimum CGPA required for the award of Associate Degree program shall be 2.00/4.00.

f) **Program Duration**: The minimum and maximum duration to complete the Associate Degree program is four (04) and six (06) regular semesters, respectively. In extraordinary circumstances, and subject to approval of the concerned statutory body of the university, the maximum duration to complete the degree program may further be extended to another semester.

Annex-B

ADAI–Associate Degree in Artificial Intelligence (2 Years Program) & ADCS - Associate Degree in Computer Science (2 Years Program) with specialization in (Web Development & Mobile Application Development)

Areas	Credit Hours	Courses
Computing Core	31	9
Electives	15	5
Supporting Courses	03	1
General Education Requirement	21	8
Totals	**72**	**23**

#	Sem #	Code	Pre-Reqs	Course Title	Dom	Cr hr
				Computing Core (33/72) 9 Courses		
1	1	CSC-101		Programming Fundamentals	Core	4 (3-3)
2	2	CSC-102	PF	Object Oriented Programming	Core	4 (3-3)
3	2	CSC-103		Database Systems	Core	4 (3-3)
4	2	CSC-111		Digital Logic Design	Core	3 (2-3)
5	3	CSC-201	OOP	Data Structures	Core	4 (3-3)
6	3	CSC-203		Artificial Intelligence	Core	3 (2-3)
7	2	CSC-204		Computer Networks	Core	3 (2-3)
8	3	CSC-211	DLD	Computer Organization & Assembly Language	Core	3 (2-3)
9	4	CSC-205		Software Engineering	Core	3 (3-0)
10	4	CSC-497		FYP/Internship	Core	2 (0-6)
Electives (15/72) 5 Courses/Labs (Program should have 2 Labs & 3 courses … Universities can add more Courses and Labs)						
11		CSC-303		Advance Database Management Systems	Elective	3 (2-3)
12		CSC-251		Web Technologies	Elective	3 (2-3)
13		CSC-252		Advanced Programming	Elective	3 (2-3)
14		CSC-351		Web Engineering Lab	Elective	3 (1-6)
15		CSC-253		Full Stack Web Design & Development Lab	Elective	3 (1-6)
.		CSC-353		Mobile Application Development 1 Lab	Elective	3 (1-6)
.		CSC-451		Mobile Application Development 2 Lab	Elective	3 (1-6)
.		CAI-262		Machine Learning	Elective	3 (2-3)
.		CAI-364		Natural Language Processing	Elective	3 (2-3)
.		CAI-261		Programming for AI Lab	Elective	3 (1-6)
.		CAI-361		Artificial Neural Networks & Deep Learning Lab	Elective	3 (1-6)

.		CSC-202		Information Security	Elective	3 (2-3)
.		CSC-354		Cyber Security Lab	Elective	3 (1-6)
Supporting Courses (3/72) 1 Course						
16		MTH-103	CAG	Linear Algebra	Supp	3 (3-0)
.		CSC-301		Operating Systems	Supp	3 (2-3)
General Education Requirement (21/72) 8 Courses						
17	1	CSC-100		Application of Information & Communication Technologies	GER	3 (2-3)
18	1	ENG-102		Functional English	GER	3 (3-0)
19	2	ENG-201	ECC	Expository Writing	GER	3 (3-0)
20	1	CSC-110		Quantitative Reasoning– 1 (Discrete Structures OR STT-101 Probability & Statistics)	GER	3 (3-0)
21	1	MTH-101		Quantitative Reasoning– 2 (Calculus and Analytic Geometry)	GER	3 (3-0)
22	4	IS-201		Islamic Studies/Ethics	GER	2 (2-0)
23	1	SSH-201		Pakistan Studies	GER	2 (2-0)
24	4	SSH-401		Entrepreneurship	GER	2 (2-0)

Annex-B

Associate Degree in Computer Science with specialization in (Web Development)

#	Code	Pre-Reqs	Course Title	Domain	Cr hr (Conthr)
			Semester 1		
1	CSC-101		Programming Fundamentals	Core	4 (3-3)
2	CSC-100		Application of Information & Communication Technologies	GER	3 (2-3)
3	CSC-110		QR 1 (Discrete Structures)	GER	3 (3-0)
4	MTH-101		QR 2 (Calculus and Analytic Geometry)	GER	3 (3-0)
5	ENG-102		Functional English	GER	3 (3-0)
6	SSH-201		Pakistan Studies	GER	2 (2-0)
				Total Cr Hrs	**18 (16-6)**
			Semester 2		
7	CSC-102		Object Oriented Programming	Core	4 (3-3)
8	CSC-103		Database Systems	Core	4 (3-3)
9	CSC-111		Digital Logic Design	Core	3 (2-3)
10	CSC-203		Artificial Intelligence	Core	3 (2-3)
11	CSC-204		Computer Networks	Core	3 (2-3)
12	ENG-201		Expository Writing	GER	3 (3-0)
				Total Cr Hrs	**20 (15-15)**
			Semester 3		
13	CSC-201		Data Structures	Core	4 (3-3)
14	CSC-301		Operating Systems	Supp	3 (2-3)
15	CSC-211		Computer Organization & Assembly Language	Core	3 (2-3)
16	CSC-251		Elective 1 (Web Technologies)	Elective	3 (2-3)
17	CSC-303		Elective 2 (Advance Database Management Systems)	Elective	3 (2-3)
				Total Cr Hrs	**16 (12-12)**
			Semester 4		
18	CSC-205		Software Engineering	Core	3 (3-0)
19	CSC-252		Elective 3 (Advanced Programming)	Elective	3 (2-3)
20	CSC-351		Elective 4 (Web Engineering Lab)	Elective	3 (1-6)
21	CSC-253		Elective 5 (Full Stack Web Design & Development Lab)	Elective	3 (1-6)
22	IS-201		Islamic Studies	GER	2 (2-0)
23	SSH-401		Entrepreneurship	GER	2 (2-0)
24	CSC-497		FYP/Internship		2 (0-6)
				Total Cr Hrs	**18 (11-21)**

Associate Degree in Computer Science with specialization in (Mobile App Development)

#	Code	Pre-Reqs	Course Title	Domain	Cr hr (Conthr)
Semester 1					
1	CSC-101		Programming Fundamentals	Core	4 (3-3)
2	CSC-100		Application of Information & Communication Technologies	GER	3 (2-3)
3	CSC-110		QR 1 (Discrete Structures)	GER	3 (3-0)
4	MTH-101		QR 2 (Calculus and Analytic Geometry)	GER	3 (3-0)
5	ENG-102		Functional English	GER	3 (3-0)
6	SSH-201		Pakistan Studies	GER	2 (2-0)
				Total Cr Hrs	**18 (16-6)**
Semester 2					
7	CSC-102		Object Oriented Programming	Core	4 (3-3)
8	CSC-103		Database Systems	Core	4 (3-3)
9	CSC-111		Digital Logic Design	Core	3 (2-3)
10	CSC-203		Artificial Intelligence	Core	3 (2-3)
15	CSC-204		Computer Networks	Core	3 (2-3)
12	ENG-201		Expository Writing	GER	3 (3-0)
				Total Cr Hrs	**20 (16-12)**
Semester 3					
13	CSC-201		Data Structures	Core	4 (3-3)
14	CSC-301		Operating Systems	Supp	3 (2-3)
15	CSC-211		Computer Organization & Assembly Language	Core	3 (2-3)
16	CSC-251		Elective 1 (Web Technologies)	Elective	3 (2-3)
17	CSC-353		Elective 2 (Mobile Application Development 1 Lab)	Elective	3 (1-6)
				Total Cr Hrs	**16 (12-12)**
Semester 4					
18	CSC-205		Software Engineering	Core	3 (3-0)
19	CSC-252		Elective 3 (Advanced Programming)	Elective	3 (2-3)
20	CSC-303		Elective 4 (Advance Database Management Systems)	Elective	3 (2-3)
21	CSC-451		Elective 5 (Mobile Application Development 2 Lab)	Elective	3 (1-6)
22	IS-201		Islamic Studies	GER	2 (2-0)
23	SSH-401		Entrepreneurship	GER	2 (2-0)
24	CSC-497		FYP/Internship	Core	2 (0-6)
				Total Cr Hrs	**18 (11-21)**

Annex-C

ADAI –Associate Degree in Artificial Intelligence

#	Code	Pre-Reqs	Course Title	Domain	Cr hr (Conthr)
Semester 1					
1	CSC-101		Programming Fundamentals	Core	4 (3-3)
2	CSC-100		Application of Information & Communication Technologies	GER	3 (2-3)
3	STT-101		QR 1 (Probability & Statistics)	GER	3 (3-0)
4	MTH-101		QR 2 (Calculus and Analytic Geometry)	GER	3 (3-0)
5	ENG-102		Functional English	GER	3 (3-0)
6	SSH-201		Pakistan Studies	GER	2 (2-0)
				Total Cr Hrs	**18 (16-6)**
Semester 2					
7	CSC-102		Object Oriented Programming	Core	4 (3-3)
8	CSC-103		Database Systems	Core	4 (3-3)
9	CSC-111		Digital Logic Design	Core	3 (2-3)
10	CSC-203		Artificial Intelligence	Core	3 (2-3)
11	CSC-204		Computer Networks	Core	3 (2-3)
12	ENG-201		Expository Writing	GER	3 (3-0)
				Total Cr Hrs	**20 (16-12)**
Semester 3					
13	CSC-201		Data Structures	Core	4 (3-3)
14	MTH-103		Linear Algebra	Supp	3 (3-0)
15	CSC-211		Computer Organization & Assembly Language	Core	3 (2-3)
16	CSC-251		Elective 1 (Web Technologies)	Elective	3 (2-3)
17	CAI-262		Elective 2 (Machine Learning)	Elective	3 (2-3)
				Total Cr Hrs	**16 (12-12)**
Semester 4					
18	CSC-205		Software Engineering	Core	3 (3-0)
19	CAI-364		Elective 3 (Natural Language Processing)	Elective	3 (2-3)
20	CAI-261		Elective 4 (Programming for AI Lab)	Elective	3 (1-6)
21	CAI-361		Elective 5 (Artificial Neural Networks & Deep Learning Lab)	Elective	3 (1-6)
22	IS-201		Islamic Studies	GER	2 (2-0)
23	SSH-401		Entrepreneurship	GER	2 (2-0)
24	CSC-497		FYP/Internship		2 (0-6)
				Total Cr Hrs	**18(11-21)**

Courses for Lab (Remaining are same as approved BSCS Courses)

1. **Programming for AI**
2. **Artificial Neural Networks and Deep Learning**
3. **Mobile Application Development-I**
4. **Mobile Application Development-II**
5. **Web Engineering**
6. **Full Stack Web Design & Development**

1. Programming for AI (Lab) (CAI-261)

Week 1: Python Basics I	
	Introduction to Python
	Data types and variables
	Control structures (if/else, loops)
	Functions and basic error handling
Week 2: Python Basics II	
	Lists, dictionaries, sets, and tuples
	File I/O (text/CSV)
	Intro to working with modules and packages
Week 3: Object-Oriented Programming in Python	
	Classes and objects
	Constructors, attributes, and methods
	Inheritance and polymorphism
	Example of OOP, Keras Classes in python
Week 4: NumPy and Pandas Basics	
	NumPy arrays and matrix operations
	Intro to Pandas DataFrames and Series
	Importing, exploring, and cleaning datasets
	GroupBy, pivot tables, multi-indexing
Week 5: Pandas Contd.	
	GroupBy and aggregation
	Pivot tables and multi-indexing
	Merging, joining, reshaping data
Week 6: Data Visualization	
	Matplotlib and Seaborn basics
	Plot types: line, bar, histogram, boxplot, scatter, heatmaps
	Styling and saving plots
Week 7: Data Preprocessing Techniques	
	Handling missing values
	Dealing with outliers (IQR, Z-score)
	Encoding categorical variables (label, one-hot)
	Scaling (min-max, standardization)
Week 8: Dataset Balancing & Splitting	
	Class imbalance: oversampling (SMOTE), undersampling
	Train/test split and stratification

	Intro to evaluation metrics (accuracy, precision, recall, F1)
	K-Fold, Stratified K-Fold
Week 9: Web end point using Flask	
	Basics of Flask: routing
	Dynamic URL parameters
	Post and Get request using Controller Actions
	Training basic ML model and deploying it using Flask
Week 10: Basics of Image Processing	
	Introduction to images as arrays
	Reading and displaying images using OpenCV & matplotlib
	Sampling and Quantization in Images
	Understanding gray scale images
Week 11: Intensity transformation and preprocessing	
	Applying intensity transformation (Gamma Correction)
	Piece Wise Linear Tranformation
	Poor and Highcontrast images, Histogram
	Histogram Equalization
Week 12: Spatial Transformation	
	What is convolution in image processing?
	Low-pass filters (blurring, smoothing)
	High-pass filters (edge enhancement)
	Using Filter as preprocessing tool
Week 13: Edge Detection in Images	
	Edge detection Basics
	Gradient-based methods: Sobel, Prewitt, Roberts
	Effect of Noise in Edge Detection
	Canny Edge Detection
Week 14: Edge Detection in Images	**Flask for Image Processing**
	Uploading and handling image files
	Loading and using ML models in Flask
	Returning processing image using Flask
Week 15: Image Segmentation	
	Region based segmentation
	Merging and Spilit techniques
	Motion based segmentation
Week 16: Mini Project and Presentation	
	Course Wrapup
	Mini project Checking

Reference Materials:

1. "PythonCookbook",DavidBeazley,BrianK.Jones,3rdEdition,O'Reilly, 2013.
2. "ArtificialIntelligencewithPython",PrateekJoshi,PacktPublishing,2017.
3. "Hands-on Machine Learning with Scikit-Learn and TensorFlow", Aurélien Géron, O'Reilly, 2017.

2. Artificial Neural Networks and Deep Learning (Lab) (CAI-361)

Week 1: Perceptron	
	Revision of keras , pandas, numpy, matplotlib
	Introduction to tensorflow
	Implementation of perceptron from scratch
Week 2: Fully Connected Neural Networks (FCNN)	
	Activation functions implementation
	Design a Feed Forward Neural Network from scratch
	Loss functions (MSE, MAE)
Week 3: Back Propagation Neural Networks (BPNN)	
	Gradient Descent
	Working of different optimizers (Adam, RMSPropetc)
	Designing First NN for classification problem using categorical data
	Designing First NN for regression problem
Week 4: Convolutional Neural Network	
	Reading Images using python (opencv-python)
	Storing images in a csv file for processing
	Apply different processing on colored images
	Image processing using Simple Neural networks
Week 5: CNN (Pretrained models)	
	Design first CNN for classification of images
	Setting parameters in convolutional and Pooling Layers (stride, kernel, kernel size, padding, etc)
	LeNet, ALexNet, VGG, and RsNetArchitectuures implementation.
Week 6: Autoencoders	
	Implementation of autoencoders in python
	Implementation of Denoising Autoencoders
	Implementation of Variational Autoencoders
Week 7: Generative Adversarial Networks (GANs)	
	Using GAN model for generation of Images
	Implementation of DC GANs
	Implementation of Style GANs
Week 8: GANs (continued)	
	Implementation of Star GANs
	Implementation of Pix2pix GANs
	Implementation of progressive GANs
Week 9: Self Organizing Maps	
	Implementation of SOM for clustering of digits dataset
	Implementation of SOM for classification purposes
Week 10: Graph Neural Networks (GNN)	
	Implementation of Graph Convolutional NN (GCNN) for images
	Implementation of GNN for text classification problems
	Implementation of GNN for segmentation
Week 11: MobileNet	
	Implementation of MobileNetv1
	Implementation of MobileNetv2, Implementation of MobileNetv3

Week 12: Region -based CNN	
	Using CNN for object detection
	IoU, NMS implementation in python
	Implementation of RCNN for object detection
Week 13: Masked RCNN	
	Implementation of Faster RCNN
	Implementation of Masked RCNN for segmentation
Week 14: YOLO	
	Implementation of YOLO v1 for object detection
	Implementation of YOLO v2
	Implementation of YOLO v3
Week 15: Audio processing using CNN	
	Extracting features from audios using librosa
	Using CNN for Audio classification
Week 16: Revision	
	Course Wrapup
	Pproject Checking

Reference Materials:

1. Neural Network Design, 2nd Edition, Martin T. Hagan, Howard, B. Demuth, Mark Hudson Beale and Orlando De Jesus, Publisher: Martin Hagan; 2edition (September 1, 2014), ISBN-10: 0971732116.
2. Fundamentals of Artificial Neural Networks, Mohammad Hassoun, Publisher: A Bradford Book (January 1, 2003), ISBN-10: 026251467.
3. Deep Learning by Ian Good Fellow, Y Bengio,GHinton,2016MIT Press
4. DeeplearningwithPythonbyFChollet,2017

3. Mobile Application Development-I (Lab) (CSC-353)

Week 1: Introduction	
	Introduction to Mobile Computing
	Evolution of mobile devices
	Native vs Hybrid vs Cross platform apps
	IDE Setup and introduction
Week 2: Programming Basics I	
	Variables, data types, operators
	Control structures (if, switch)
	Loops, functions (lambda, closure, arrow)
Week 3: Programming Basics II	
	Arrays and collections
	Classes, objects, inheritance
	Encapsulation and polymorphism
Week 4: First Application	
	Application life cycle
	Deploying/Running application on real device or virtual device
	UI Components • Buttons • Text Views • Text Fields • Linear Layout/Row/Columns

Week 5: Input Validation & Event Handling	
	Input Validation
	Click listeners
	Radio Buttons
	Check Box Code debugging
Week 6: Drop Down & Lists	
	Drop down creation from list
	Handling on change of selection
	List view creation
	List item click listeners
	Display lists with images
Week 7: Modals	
	Menus & Dialog Boxes
	App menus
	Alert Dialogs, custom dialogs
	Bottom sheet
Week 8: Navigation I	
	Navigation Between Screens
	Intents, passing data
	Splash screen & App icon design
	Tab Layout
Week 9: Navigation II	
	Drawer
	Bottom Navigation
	Custom Navigation Bar
Week 10: Data Persistence I	
	Shared Preferences
	Storing non-primitive types
	Storing objects
	Storing lists
Week 11: Data Persistence II	
	File Handling (Create, Read and Write)
	SQLite CRUD operations
Week 12: Data Persistence III	
	Introduction to Room
	Advantages of Room over SQLite
	Components of Room
	CRUD operations
Week 13: Responsive App	
	Responsive UI Design
	Support for screen sizes
	Orientation handling
Week 14: Theme& Animations	
	Dark Mode vs Light Mode
	Theme switching

	Animations
Week 15: Multi Media	
	Multimedia Integration
	Playing audio and video from assets
Week 16: Mini Project and Presentation	
	Course Wrap-up
	Mini project Checking

Reference Materials:

1. React Native: Dabit, N. (2019). React native in action: Developing iOS and Android apps with JavaScript. Manning Publications Co.
2. Flutter: Windmill, E. (2020). Flutter in action. Manning Publications Co.
3. Android Developer Guide (2024). Android Mobile App Developer Tools – Android Developers. https://developer.android.com/

4. Mobile Application Development-II (Lab) (CSC-451)

Week 1: Introduction	
	Recap of Mobile App-I & App Architecture
	MVC, &MVVM
	Project structuring
Week 2: Permissions & Data Sharing	
	Runtime Permission (Accessing camera or gallery)
	Sharing data between app (sharing image on video from app to WhatsApp)
Week 3: Firebase I	
	Introduction to Firebase
	Creating database
	Authentication Systems
	Local login and registration
	Firebase/Auth0 overview
Week 4: Firebase II	
	CRUD operations with live sync
	Capture or select image
	Upload to cloud storage
Week 5: Notifications	
	Local notifications
	Real time chat using firebase
	Push notifications using firebase
	Notifications using one signal
Week 6: REST API- I	
	Working with REST APIs
	Making GET/POST requests
	JSON parsing
Week 7: REST API-II	
	Handling Objects
	Handling Lists
	Handling Files

	Handling Authentication Tokens
Week 8: Maps-I	
	Maps and Location Integration
	Google Maps / OpenStreetMap
	Current location & markers
	Distance calculation
	Handling Marker clicks
Week 9:Maps-II	
	Live Tracking
	Geo Fencing
	Location Services
	Geocoding (searching a place via name)
	Integration with Firebase for location updates or real-time features
	Map caching (use when internet is not available)
Week 10: Background Tasks & Scheduling	
	Alarm Manager / Background Sync
	Running background threads
	Foreground services (music player, location tracker)
Week 11: Sensors	
	Reading data from sensors like • Fingerprint Sensor • Heart Rate Sensor • Step Counter/Step Detector • Face Detection Sensors
Week 12: Bluetooth Communication	
	Get available devices
	Pair via Bluetooth
	Sending data using Bluetooth
Week 13: Socket Programming	
	Communicate mobiles using socket programming
	Asynchronous communication
	Chatting app
Week 14: Google Adds	
	Banner Ads
	Interstitial Ads
	Rewarded Ads
	Native Ads
Week 15: Audio	
	Audio Recording • Record from microphone • Save audio in formats like MP3, WAV
	Voice Notes / Messaging • WhatsApp-style voice messages • Show recording progress and playback waveform • Upload recorded audio to Firebase / serve
Week 16: Mini Project and Presentation	
	Course Wrap-up
	Mini project Checking

Reference Materials:

1. Android: Hardy, B., & Phillips, B. (2018). Android programming: The big nerd ranch guide. Big Nerd Ranch Guides.
2. iOS: Apple Inc. (2020). Swift programming language. Apple Inc.
3. Kotlin: Nagy, R., & Nagy, R. (2022). Simplifying Application Development with Kotlin Multiplatform Mobile. Packt Publishing.

5. Web Engineering (Lab) (CS-351

Week 1: ASP.NET MVC (.NET Framework)	
	Overview of .NET Framework, architecture?
	MVC vs Web Forms,
	What is MVC
	Installing Visual Studio
	Creating your first ASP.NET MVC project
Week 2: MVC Design Pattern and Routing	
	Understanding the MVC (Model, View, Controller)
	Request lifecycle in MVC
	Folder structure
	Default routing with RouteConfig.cs
	Custom routes
	Route parameters
Week 3: Controllers	
	Creating controllers
	Action methods
	Return statement
	Passing data to views
	Returning different action results (View(), RedirectToAction())
Week 4: Views and Razor Syntax	
	Razor basics (@, @{})
	Layout pages (_Layout.cshtml)
	Data: Controller to View
	ViewBag
	Simple Form Helpers
	Data: View to Controller
Week 5: Models and Data Access	
	Creating models
	Data annotations for validation
	Passing Model to action
	Model to the view
Week 6: Strongly Typed View	
	Strongly Typed Form Helpers
	Begin Form
	Texbox, Radio, Dropdown, checkbox and submit
	Get and post requests
	Data submitted on server
Week 7: Database Connectivity	

	SQL Server Database
	ADO.Net Classes
	Insert data in table from View
	Display data on View
Week 8: Detail, Delete and Edit	
	Fetch detailed information from DB table
	Delete a row from table
	Edit a record in database table
Week 9: State Management	
	Client side
	Server side
	Login: Manage the state of user on server by Session
	Dashboard View
	QueryString
Week 10: Cookies and Hidden Field	
	Manage user data on client side using cookies
	Persistent cookies and non-persistent cookies
	Color theme and user information
	Submit data by hiding the user with hidden field
	Practical example
Week 11: File Uploading	
	Submit data in multi-part
	Image uploading on server
	Store path in DB
	Retrieve images on View from server
	Image gallery
Week 12: Pagination and Configuration	
	Apply pagination
	Configuration settings, Database, Request length, Error
Week 13: Partial view and View model	
	Partial view , View Model, Checkbox List handling
Week 14: Web API	**Asp.net web API framework?**
	REST APIs
	API Resources
	Post,get,delete and put requests
Week 15: Database connectivity using Web API	
	Connection with database
	Save date
	Search data, Apply filters, Update data in table, Delete a record
Week 16: Course Project	
	Demo of Project

Reference Materials:

1. Web Technologies by Uttam Kumar Roy, Oxford University Press, USA (June 13, 2011). ISBN-10: 0198066228
2. Beginning HTML, XHTML, CSS, and JavaScript by Jon DuckettWiley; 2nd Edition (2010). ISBN: 978-0-470-54070-1
3. JavaScript from Beginner to Professional, by Laurence Lars Svekis, Rob Percival, and Maaike Van Putten

4. HTML5, JavaScript and jQuery 24-Hour Trainer by Dane Cameron; ISBN: 978-1-119-00116-4, Wrox (Feb, 2015).
5. Web Technologies: A Computer Science Perspective by Jeffrey C. Jackson, Prentice Hall; 1st Edition (August 27, 2006). ISBN-10: 0131856030
6. Programming PHP Creating Dynamic Web Pages, Kevin Tatroe, Peter Macintyre, 4th Edition, O′Reilly, 2020

6. Full Stack Web Design & Development (Lab) (CSC-253)

Week 1: Introduction & Installation	
	Local setup (XAMPP/MAMP)
	cPanel installation (live server)
	Dashboard overview
Week 2: Content Management	
	Posts vs Pages
	Categories & Tags
	Media Library (image optimization)
	User roles & permission
Week 3: Themes & Customization	
	Installing free/premium themes
	Customizer basics (logo, colors, menus)
	Child themes (concept & setup)
	Installing free/premium themes
Week 4:Essential Plugins	
	Security (Wordfence), Backup (UpdraftPlus)
	SEO (Yoast/Rank Math), Caching (WP Rocket)
Week 5: Page Builders	
	Elementor vs Divi vs Gutenberg
	Drag-and-drop design
	Header/Footer customization
	Elementor vs Divi vs Gutenberg
	Guest blogging, social media, and influencer outreach
Week 6: WooCommerce Setup	
	Product pages & variations
	Payment gateways (Stripe/PayPal)
	Shipping zones
Week 7: : Forms & Interactivity	
	Contact Form 7/WPForms
	Newsletter integration (Mailchimp)
	Popup builders (OptinMonster)
Week 8: Search Engine Optimization (SEO)	
	What is SEO?
	Keyword research and optimization
	Title tags, meta descriptions, and header tags
	Link building strategies
	Guest blogging, social media, and influencer outreach
Week 9: Search Engine Optimization (SEO)	
	Website structure and sitemap

	Mobile-friendliness and page speed optimization
	Using Google Analytics and Google Search Console
	Introduction to tools like SEMrush, Ahrefs, Moz
	Website structure and sitemap
	Mobile-friendliness and page speed optimization
Week 10: E-commerce: Shopify and Amazon	
	Overview of Shopify and Amazon FBA (Fulfillment by Amazon)
	Choosing a plan, setting up a store, and customizing themes
	Adding products, product descriptions, and images
	Configuring payment gateways, Managing orders and shipping
Week 11: Social Media Marketing (Facebook, Instagram, TikTok)	
	Importance of social media for business
	Setting up a Facebook business page
	Post and Get request using Controller Actions
	Facebook Insights and analytics
	Instagram business profiles and shopping features
Week 12: Social Media Marketing (Facebook, Instagram, TikTok)	
	Creating engaging content and stories in Insta
	Using hashtags effectively
	Creating viral content on TikTok
	TikTok ads and influencer marketing
	Using TikTok for brand awareness
Week 13: Content Marketing & Blogging Strategy	
	Understanding content marketing funnels
	Creating compelling blog posts
	Using AI tools (like ChatGPT) for content generation
	Content calendars and scheduling tools (Trello)
	Understanding content marketing funnels
Week 14: Email Marketing & Lead Generation	
	Importance of email marketing
	Tools: Mailchimp, ConvertKit
	Designing email campaigns (newsletters, product launches)
	Building and segmenting an email list
Week 15: Capstone Project & Presentation	
	Students create a small business website (or redesign one) using WordPress/Shopify
	Implement UI/UX principles, SEO, email opt-in, blog, and product pages
	Students create a small business website (or redesign one) using WordPress/Shopify
Week 16: Capstone Project & Presentation	
	Integrate analytics, social media, and email tools
	Final presentation showcasing the project, insights, and tools used

Reference Materials:

1. **Eloquent JavaScript"** – Marijn Haverbeke
2. **Full Stack Web Development with React and Node.js** – Shama Hoque
3. **You Don't Know JS"** – Kyle Simpson

Annex-D

Social Network Analysis
MSCS/PhD (CS) CAI-777
Course Details

Semester:3 **Credits:**(3,0)	**Course Type:** Domain Core
Pre-requisite:	**Contact hours:**3 hours / week
Corresponding Lab Course: Nil	**Area/Domain:** AI

Course Objectives

The main objectives of the course are

- The course will introduce basic concepts and principal algorithms suitable for investigating (social) networks.
- The course will help students apply and hone their data analysis skills on social media data to find meaningful patterns
- The research-driven nature of the course will improve the critical thinking of students and will help them gain research experiences.

Reference Materials/Books

- **Analyzing Social Networks**, By Stephen P Borgatti, Martin G Everett, Jeffrey C Johnson, Filip Agneessens 2024
- **Social Network Analysis Theory and Applications,** By Buni Balabantaray, Chiai Al Atroshi, Mohammad Gouse Galety, Sachi Nandan Mohanty, 2022

CLO	CLO Description	Domain	BT Level*
CLO 1	Understand the fundamentals of social network analysis and graph-based representations.	C	2
CLO 2	Identify and analyze key network properties, including centrality measures, community structures, and link prediction.	C	2
CLO 3	Apply appropriate network analysis techniques to real-world datasets and interpret the results.	C	4
CLO 4	Develop and implement computational approaches for analyzing and visualizing complex networks.	C	4

***BT=Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A=Affective domain**

PLOs Description	
a.	Ability to apply concepts from graph theory, mathematics, and computing to analyze complex network structures.
b.	Ability to design and implement efficient solutions for network analysis problems using appropriate algorithms and models.
c.	Ability to develop expertise in social network analysis, enabling students to understand, analyze, and evaluate network structures and their applications across various domains.

Week	Weak Wise Topics
1	Introduction to Social Network Analysis, Basic Definitions in Graph Theory, Network Types and Representations
2	Basics of Graph Theory, Connected Components, Graphical Degree, Graph Isomorphism
3	Cliques, Clusters and Components
4	Network Properties, Degree distribution, Random Graph Model, Small World Network
5	Centrality measures, Degree Centrality, Closeness Centrality, Harmonic Centrality
6	Eigenvector Centrality, PageRank, HITS Centrality, Betwenness centrality
7	The Structure of the Web Link Analysis.
8	**Midterm Examination**
9	2-mode networks, Bipartite Graphs
10	Network communities, Modularity, Conductance, Spectral Clustering, Overlapping and Hierarchal Communities.
11	Information Diffusion Diffusion Models (Deterministic & Probabilistic)
12	Link prediction and Ego Networks Similarity-Based Methods Link Prediction with Machine Learning
13	Knowledge Graphs Overview Applications of Knowledge Graphs, Knowledge Graphs Standards - RDF - OWL - SPARQL
14	Application on Bibliometric Network Real world applications, Future and Challenges of SNA
15	Project Presentations

Tools and techniques in Machine Learning
MSCS/PhD (CS)
CAI-776

Course Details	
Semester:3**Credits:**(3,0)	**Course Type:** Domain Core
Pre-requisite:	**Contact hours:**3 hours / week
Corresponding Lab Course: Nil	**Area/Domain:** AI

Course Objectives

The main objectives of the course are

- To have hands-on with ML Tools & Libraries
- To understand techniques for handling missing data, normalization, encoding, and dimensionality reduction.
- To apply model evaluation strategies like cross-validation, confusion matrices, ROC curves.
- To gain practical experience using industry-standard tools like Python, Scikit-learn, Pandas, NumPy, Matplotlib / Seaborn, TensorFlow / PyTorch*(for advanced* sections)
- To gain skills useful in research, data science roles, or ML engineering positions.

Reference Materials/Books

- Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow_ Concepts, Tools, and Techniques to Build Intelligent Systems, AurélienGéron, 3rd Edition, O'Reilly,2022**.**
- Python for Data Science For Dummies, John Paul Mueller, Luca Massaron , null Edition, John Wiley & Sons, Inc,.
- Learning R, Richard Cotton, 1st Edition, O'Reilly,2013., Chiai Al Atroshi, Mohammad GouseGalety, SachiNandanMohanty, 2022

CLO	CLO Description	Domain	BT Level*
CLO 1	Understand the fundamental concepts, paradigms, and algorithms of machine learning.	C	2
CLO 3	Apply data preprocessing techniques and feature engineering methods on real-world datasets.	C	4
CLO 4	Develop and implement core machine learning algorithms using appropriate tools and libraries (e.g., Scikit-learn, Pandas, NumPy)..	C	4

***BT=Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A=Affective domain**

PLOs Description	
a.	Knowledge of computing and mathematics appropriate to the discipline.
b.	Problem analysis and identification in computing contexts.
c.	Design, implement, and evaluate a computer-based solution.

Week	Weak Wise Topics
1	Introduction to programming in Python. Setting up Python on a local Machine. Basic operations in Python and its syntax. Data structures in Python, lists, sets, dictionaries etc. Python built in functions for the data structures like lists as well as strings
2	Python for Machine Learning &Data Science Stack Mathematical and logical operations in Numpy. Array idexing, slicing, reshaping, broadcasting etc. Data analysis with Pandas. Series and Dataframe data structures in Pandas. Importing data from different sources. Data analysis, cleaning and visualization using Pandas and Matplotlib
3	Supervised and un-supervised learning. Evaluation metrics (Accuracy, Confusion Matrix, Precision-Recall, F-1 Score, etc.). Bias-variance trade-off. Outlier removal using statistical analysis and Sckitilearn'sbuiltin algorithms. Data dimensionality reduction using Principal Component Analysis and Linear Discriminant Analysis etc. Linear Regression using Scikit-learn.
4	Clustering and Classification algorithms using Scikit-learn. K-Means clustering, Agglomerative clustering, Mean Shift clustering etc. Classification algorithms e.g., Support vector Machine and Naive Bayes Classifier etc using Scikit Learn. Cross validation and its types.
5	MLlib library for machine learning in PySpark. MLlib data frame and Resilient Distributed Dataset based APIs. Basic statistics, ML pipelines and algorithms implementation using MLlib in PySpark.
6	Introduction to programming in R. Overview of the R programming language, its history, and its applications in data analysis, statistics, and machine learning. Installation of R and the RStudio IDE. R syntax and data types. Data structure, control structures and built in as well as user defined functions in R.
7	Data visualization in R using base R graphics and ggplot2 packages. Creation of different types of plots, customizing their appearance, and conveying insights through visualizations. Statistical Analysis in R. Descriptive statistics, hypothesis testing, regression analysis, and ANOVA. Introduction to Machine Learning in R
8	**Midterm Examination**
9	Introduction to Databases. Importance of databases and their role in managing and organizing large amounts of data. Relational Databases, the relational model, primary keys, foreign keys, and relationships between tables. Implementation of MySQL. SQL syntax and the concept of querying data from tables. Data definition and manipulation.
10	MySQL constraints (unique and check constraints etc.). Concept of indexing and its importance in improving query performance. Index types in MySQL the primary index, unique index, and various types of secondary indexes (B-tree, hash, full-text, spatial) etc. MySQL views, stored procedures and functions, triggers.
11	NoSQL databases, their characteristics, and how they differ from traditional relational databases. Various types of NoSQL databases, including document databases, key-value stores, columnar databases, and graph databases etc. Introduction to mongoDB. Implementation of CRUD operations in mongoDB.

12	MongoDBquerries, basic querry syntax, querry operators and projection. Indexing in mongoDB and its types, single-field indexes, compound indexes, multi-key indexes, and geospatial indexes. Aggregation framework in mongoDB. Working of the aggregation pipeline.
13	Replication in mongoDB including primary and secondary nodes, automatic failover, and data synchronization. Replica set configuration. Sharding in mongoDB. GrifFS for storing and retrieving large files.
14	Data analytics using MS Excel. Data analysis, cleaning and visualization. Advanced Excel functions e.g., vlookup, index-match, sumifs, and countifs etc.. What-If Analysis using Excel`s scenario manager and goal seek functionality. Solver add-in in Excel.
15	Project Presentations
16	Final